Contaminated Sediment Research at UNH

Kevin Gardner

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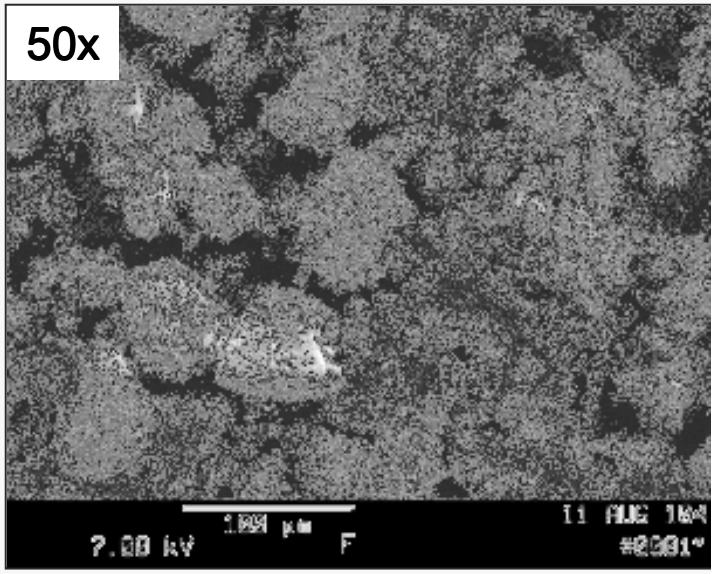
A history

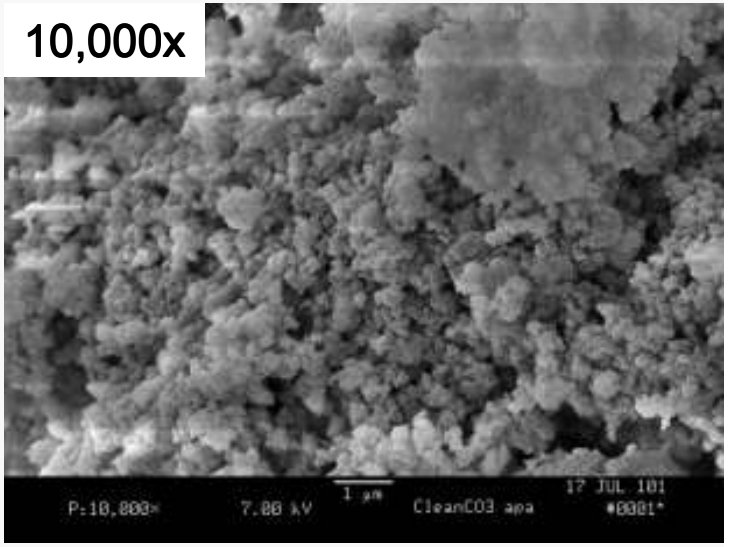
- Began UNH Contaminated Sediments Center in 1999
- Conducted over $4 million in research and development since then.
  - Dredge material management
    - Solidification/stabilization, beneficial use
  - In-situ management
    - Reactive capping, in-situ dechlorination, sequestration.

APATITE

Eighmy, Crannel, Jeff Melton

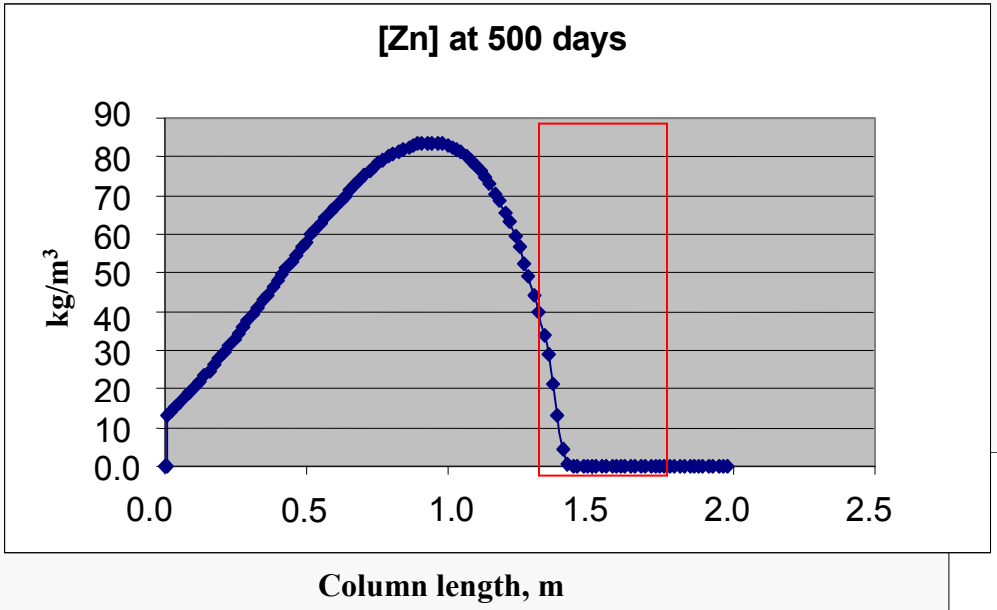
- **HYDROXYAPATITE, $Ca_5(PO_4)_3OH$,**
- **CARBONATE APATITE, $Ca_5(PO_4, CO_3)_3(F, Cl, OH)$**
- **FLUOROAPATITE, $Ca_5(PO_4)_3F$**





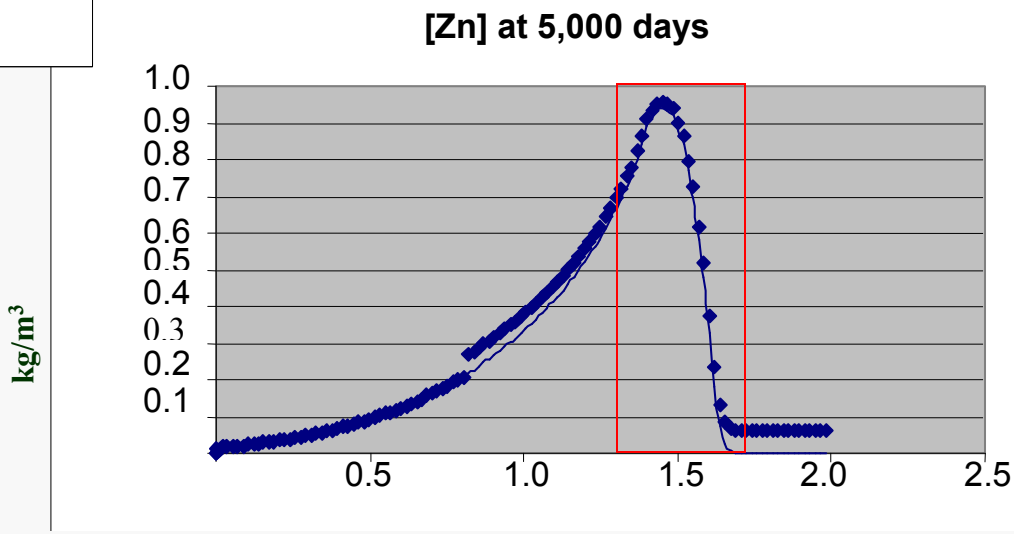
Synthetic Apatite

HYDRUS 2D

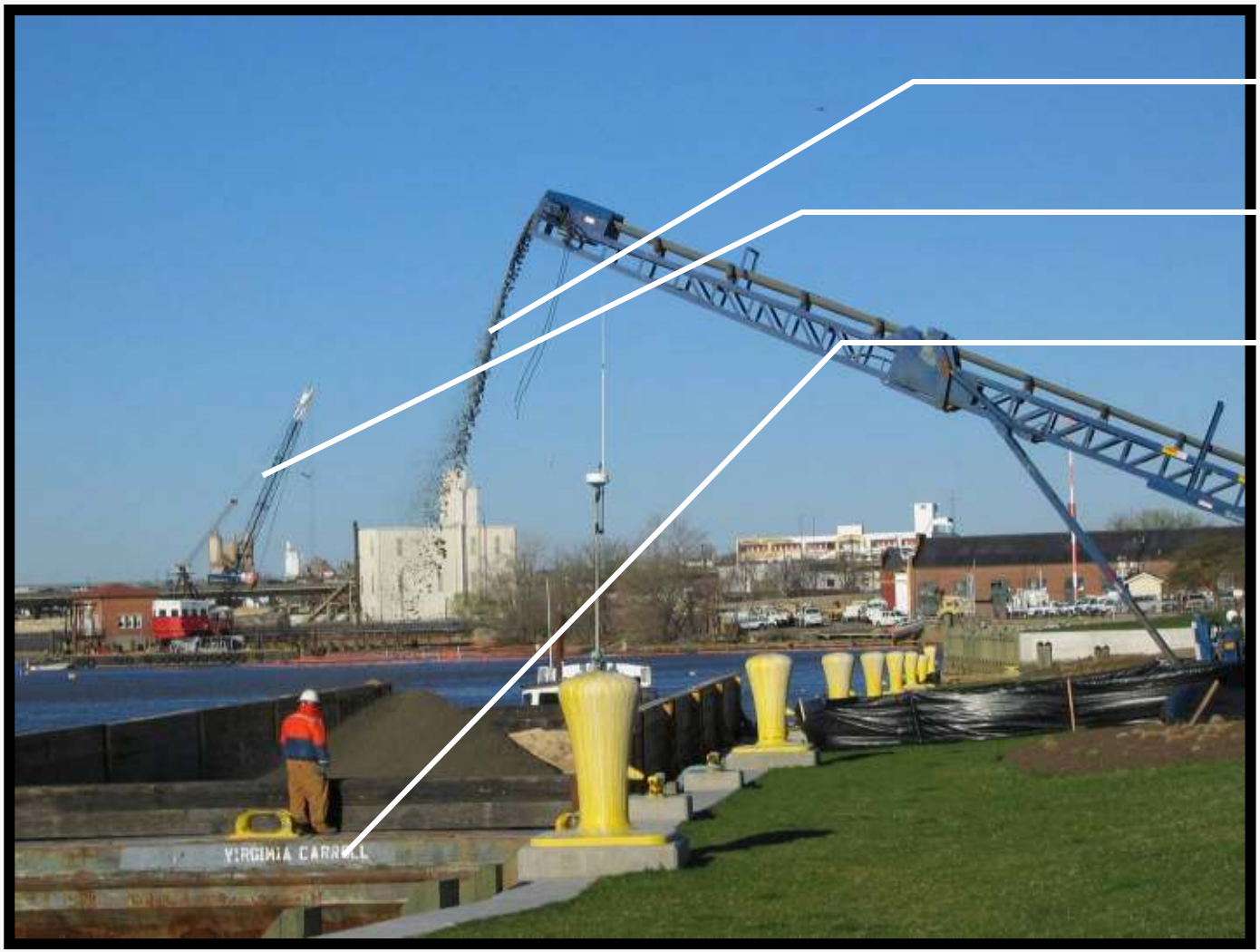


Saturated Conditions

- $[Zn]_i$ was set to 100 kg/m³
- Parameters: K_L = 0.008 L/mg and, M_{max} = 47.24 mg/g



Phosfil sand being loaded onto the barge by belt-mover.



Deployment of the Phosfil material over our capping area required two days.

2 yard bucket was filled with ¾ to 1 yard of material for each pass

Silt-screens protecting other cells

Settling plate indicator

After each row of capping material is placed, cores were taken to ensure sufficient coverage.

Coring tube with one-way valve to generate a suction of the removable end tube.

Bucket used to obtain exact GPS coordinates of cores

Clear sample cores were used for observing cap/sediment mixing and cap depth.

4” of intact cap deployed. No obvious size sorting.

1.5” of mixing between Phosfil and underlying sediments

Cocheco River
Sediment Test Bed in Dover, NH

Kevin Gardner, Contaminated Sediment Center

February 11, 2008

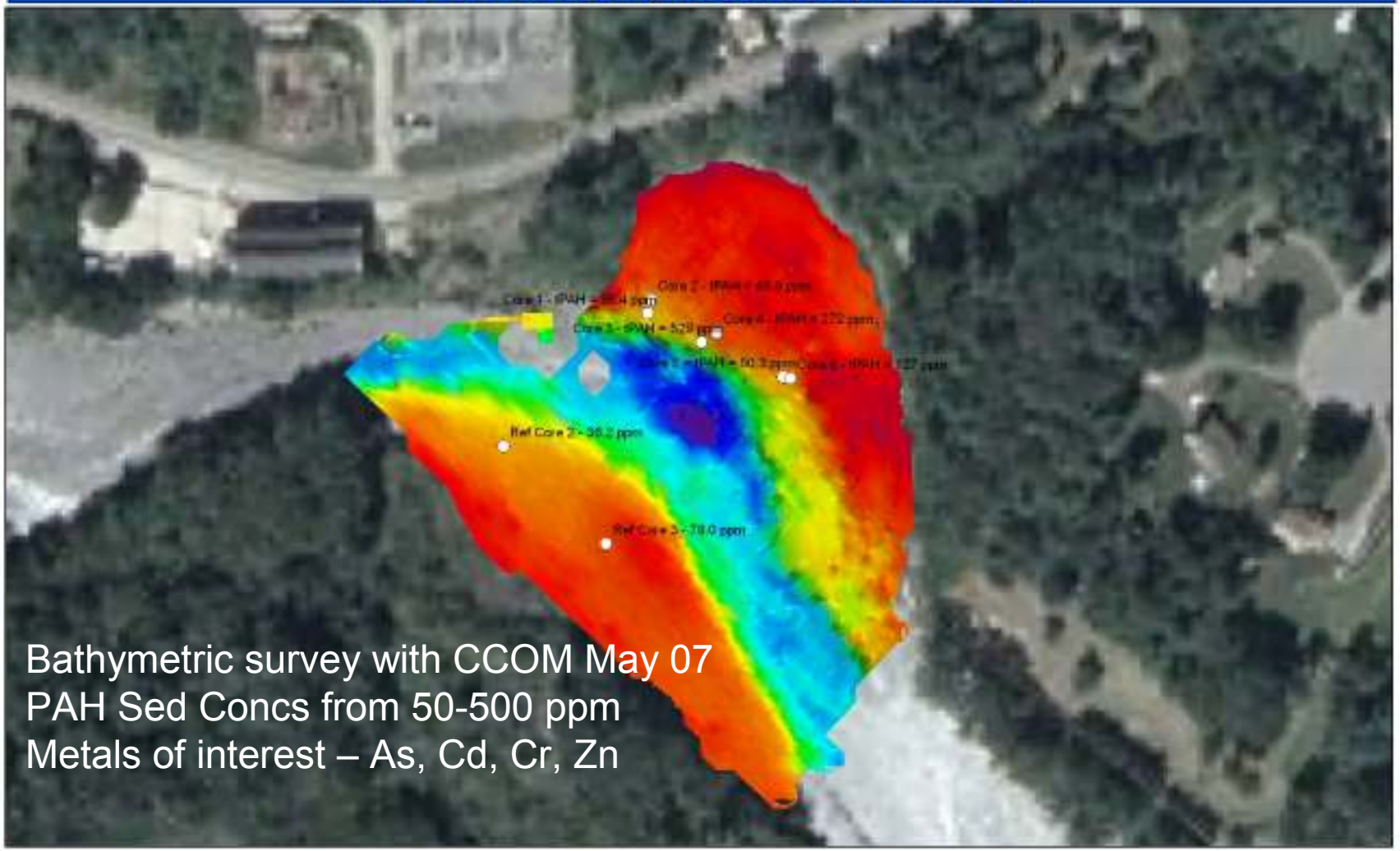
Funded by:
The Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET)
and
The NH Sea Grant

View of Site at low tide

Sed sampling with dredge in back

Oil slicks/seeps at Site

Cocheco River Bathymetry Survey (May 2007) and Core Sampling Locations (Dec 2006)



University of New Hampshire Contaminated Sediments Center
In collaboration with
University of New Hampshire's Center for Coastal and Ocean Mapping

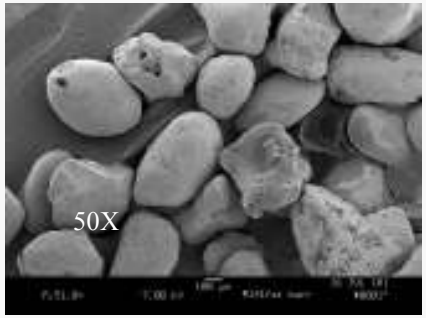
Project Manager: Dr. Kevin Gardner, P.E., Ph.D. 603-863-1445
Surveyors: Semme Dijkstra and Scott Greenwood
Sample Collection/Analysis : Deana Aulisio, Scott Greenwood, and Don Wise
Map Prepared by: Lisa Damiano and Deana Aulisio

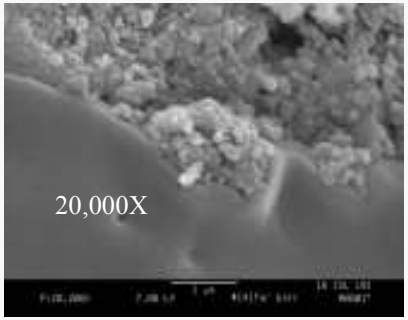
Sediment Treatment Technologies

Reactive capping

Amendment Injection & Mixing

Reactive Compounds

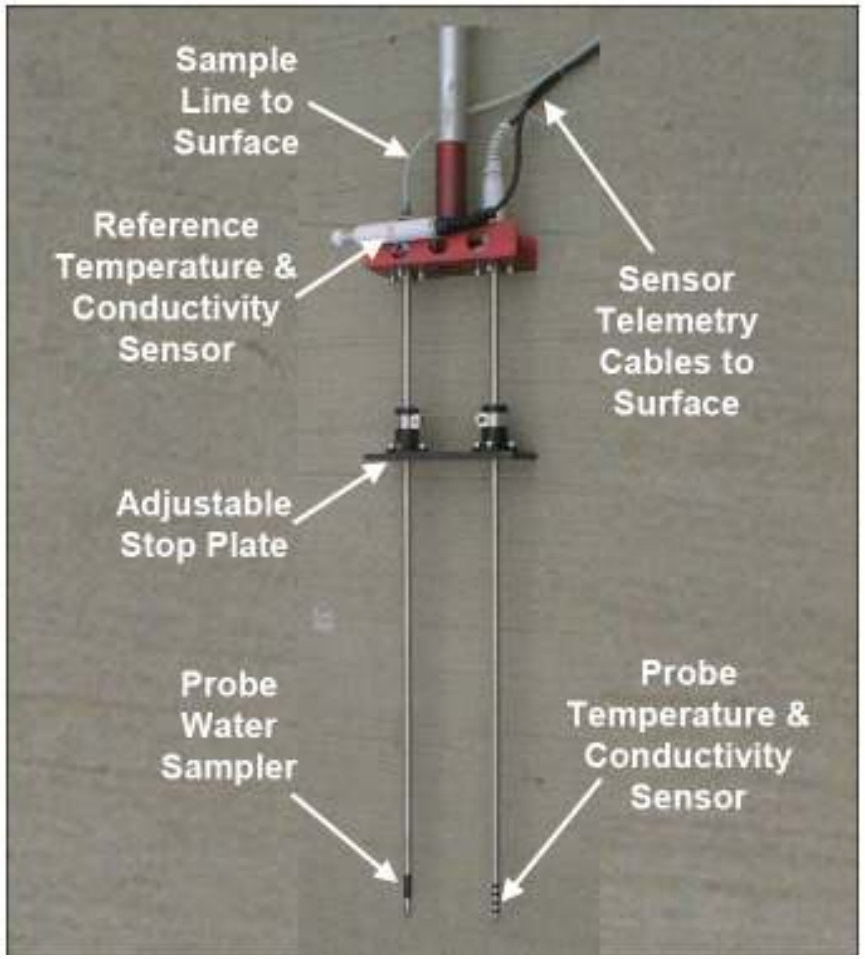




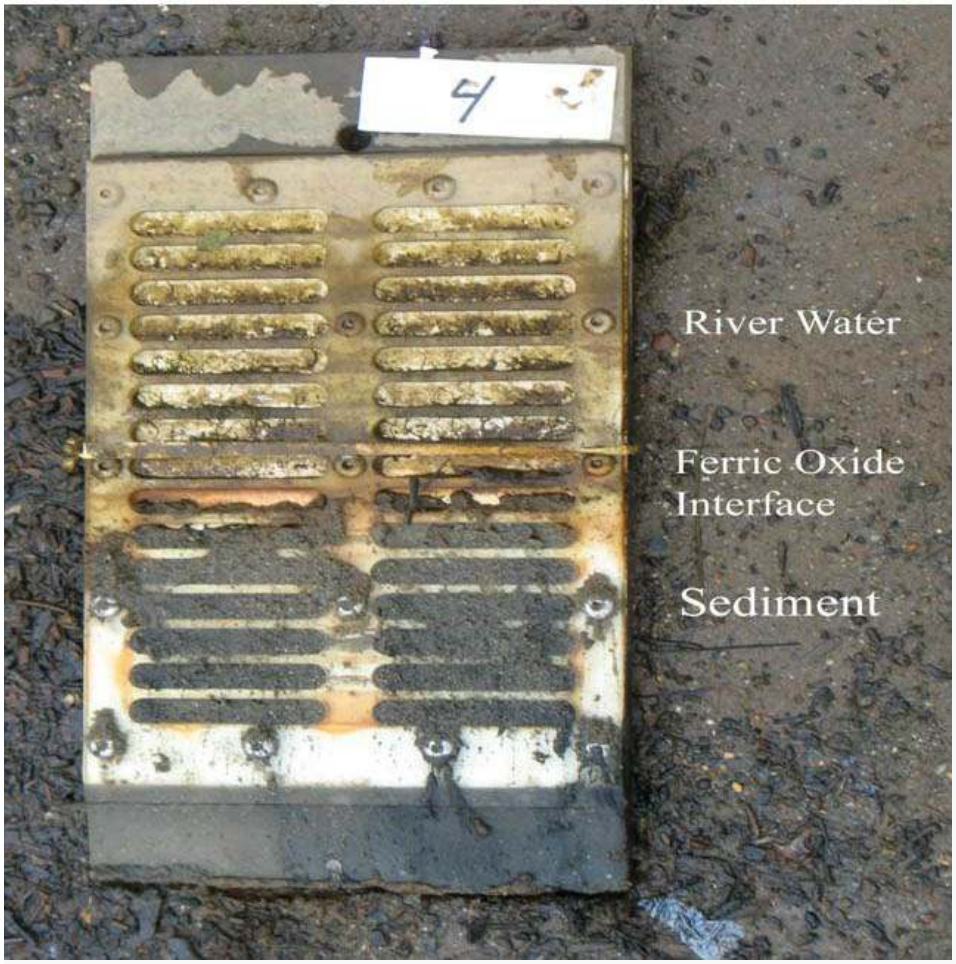
Apatite SEM

Reactive Mat with Amendments

Monitoring Technologies (1)



Trident Probe
Real time porewater sampling



Peeper
Time averaged porewater sampling for dissolved metals

Monitoring Technologies (2)

- passive time averaged sampling of porewater for organic contaminants imitates uptake into biological organisms like mussels

mussels

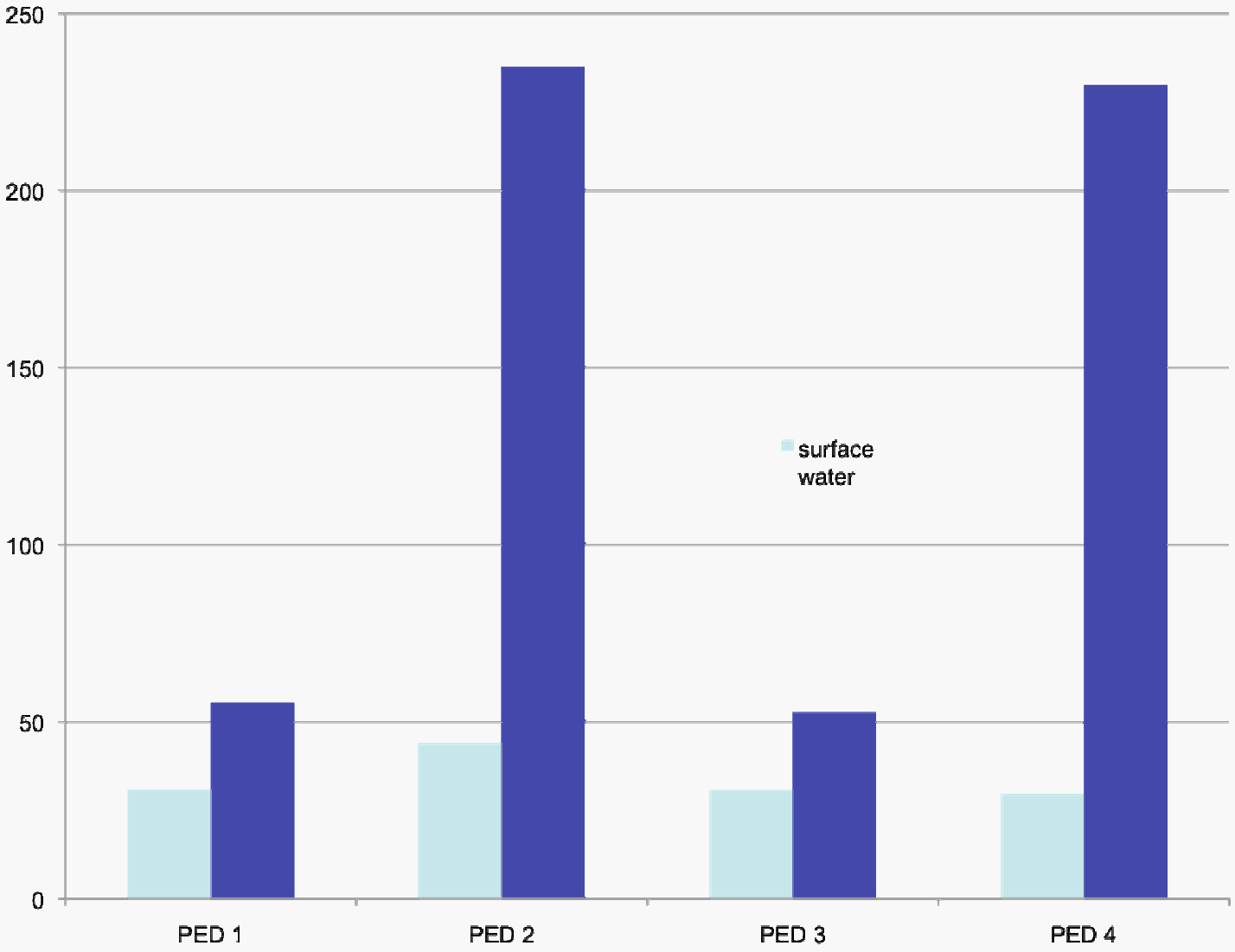
SPMD

SPMEs

polyethylene (PEDs)

One sheet of polyethylene was to adsorb PAHs from surface water, exposed at high tide, and another was submerged in the sediment, to gather data of the porewater PAH concentration. PEDs were in the field for 50 days, and PAHs were extracted by soaking the PED in Dichlormethane 2x for 24h each.

PED Results

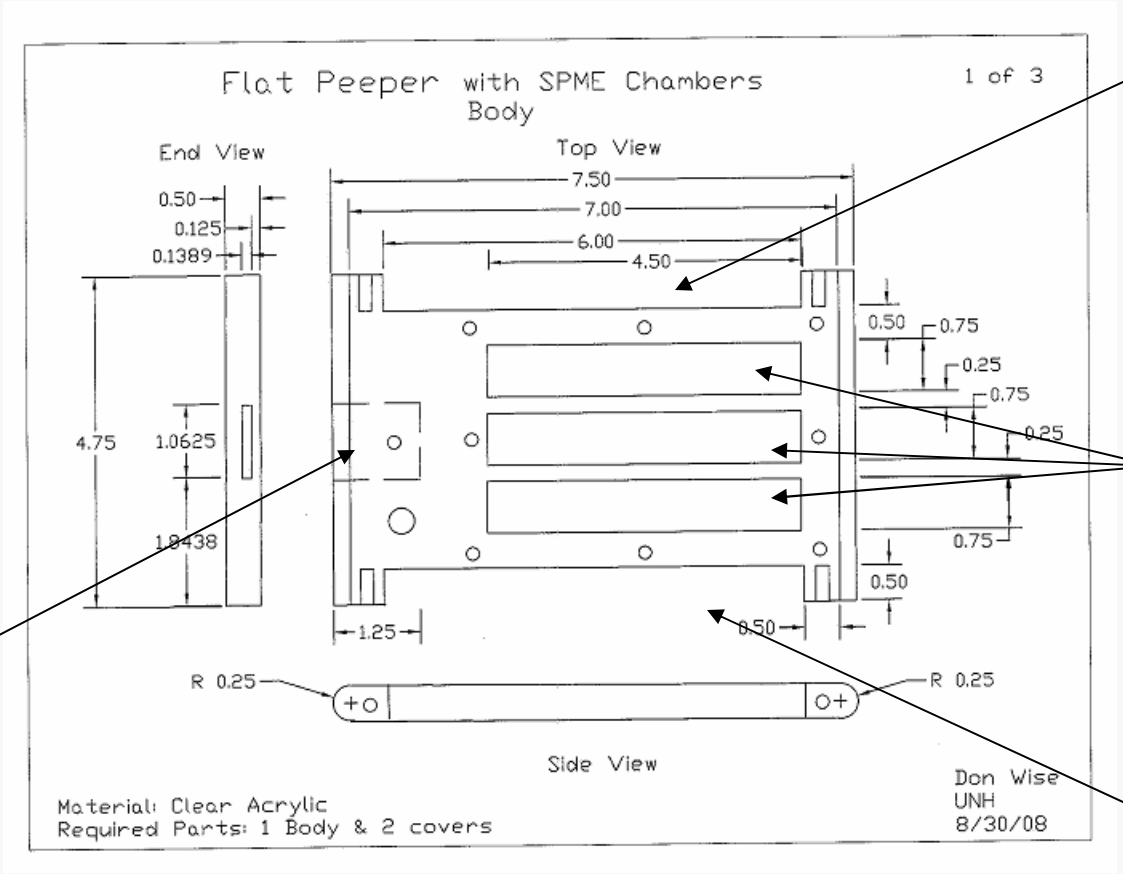


Biological Sampling

- The ultimate objective of sediment treatment is to improve the health of the estuarine community in the ecosystem by reducing the bioavailability of contaminants.
- Preliminary biological sampling in July and October 2006 showed that the benthic community was dominated by Chironomid larvae, polychaetes of the family *Terebellidae* and *Oligochaetes*.
- NH Seagrant funding will allow us to test biological effects of treatment techniques
  - Will mats smother organisms?
  - Will species borrow through mats increasing pathways for contaminants?
  - How long will it take for recruitment of new species?
  - Will the diversity be similar as before treatment?

Figure 2 – Reactive Mat Technology Deployment

Horizontal Peeper/SPME Combination Sampling Device



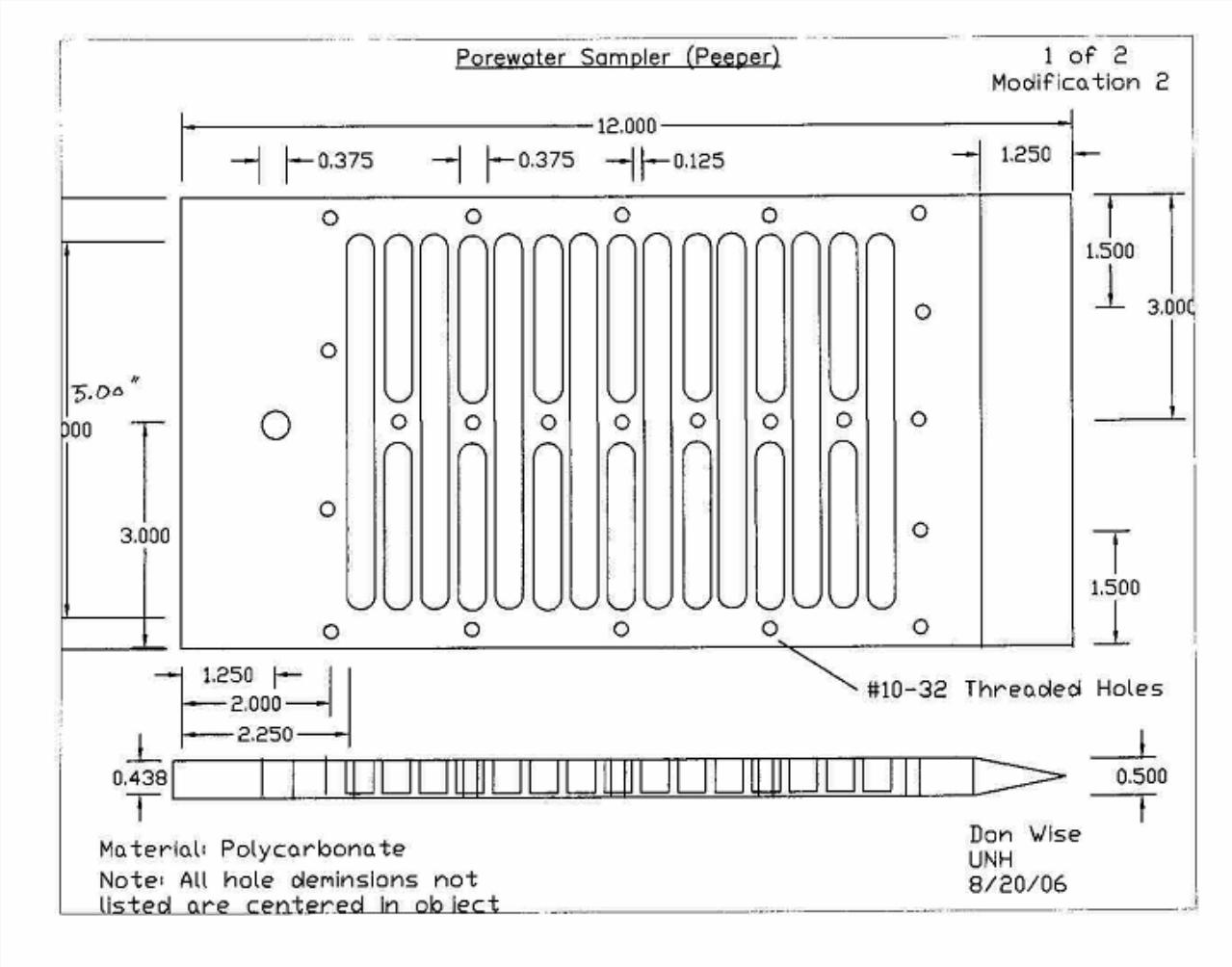
SPME Attachment

Peeper Chambers

Aluminum Flat Bar Connection

SPME Attachment

Vertical Peeper



Vertical SPME Sampler

SPME Fiber inside Device

Sorry, no fancy CAD Drawing for this one (Stainless Steel Tube with Vertical Slits Parallel to the shaft to allow PW to contact SPME fibers located inside the shaft of the device)

Other work

- Dechlorination of dioxins, PCBs by zero valent metals
- Addition of activated carbon to sediment
- Treatment of wetland soils using non-invasive methods (e.g., floating sequestration agents).